

**MEETING THE PETROLEUM AND GAS
(PRODUCTION AND SAFETY) LEGISLATIVE
REQUIREMENTS OF TREATING SLUDGE WITH
ANAEROBIC DIGESTION**



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MEETING THE PETROLEUM AND GAS (PRODUCTION AND SAFETY) LEGISLATIVE REQUIREMENTS OF TREATING SLUDGE WITH ANAEROBIC DIGESTION

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ABSTRACT

Biomethane — also known as biogas — is a hydrocarbon gas produced from the breakdown of organic matter in the absence of oxygen. Biomethane is generally produced by one of two methods:

Anaerobic digestion — biogas is produced in purpose-designed, above-ground tanks or in ponds to optimise the gas-producing decay process from human and other organic waste.

Landfill — biogas is produced by allowing natural decay to occur within a landfill site where gas is produced and then extracted.

The Petroleum and Gas (Production and Safety) Act 2004 and the Petroleum and Gas Regulation 2004 govern the safe operation and management of biomethane gas installations. Biomethane, including gas produced from waste disposal tips and treatment of sewage, is defined as petroleum and fuel gas under the Petroleum & Gas Act and the Regulation. As such treatment plant owners and operators must be aware of their responsibilities in accordance with the Act.

This paper describes the issues encountered by Allconnex Water/Gold Coast Water/Gold Coast City Council in our endeavours to comply with the Act and Regulation relative to the construction of a new digester at Coombabah Treatment Plant and the retrofitting of a 35-year-old digester at Elanora Treatment Plant.

1.0 INTRODUCTION

In 2009 Gold Coast Water accepted the design for the Stage 5 upgrade at the Coombabah Sewage Treatment Plant (STP). Part of the upgrade was the design and construction of two 6 ML anaerobic digesters. It was identified during the risk assessment and design investigation of the digesters that compliance with the *Petroleum and Gas Act 2004* (The Act) and *Petroleum and Gas Regulation 2004* was going to be a requirement of this plant.

Gold Coast Water operates a second smaller treatment plant at Elanora STP. This plant has been operational for 35 years and has three digesters each holding 27 ML, 15 ML and 15 ML each respectively. The Elanora plant, while not having any major gas-related incidents in its operating history, was found to be non-compliant with the Act and Regulation. Implementation of policies and procedures and a refurbishment plan were required to assist Elanora STP in becoming compliant.

The current Act replaced a previous version in 2004 to make the responsible persons within the Act those who are directly affected and understand the risks, so that they could make the best decision on risk management. The previous Act tried to cover every possible risk associated with petroleum and gas production and provided direction on how to address them. In an industry that is continually growing and with the advancements in technology, the Act needed to be updated.

Not having any previous experience in dealing with the Act, Gold Coast Water put together a team of staff from within the organisation to collaborate and work together in the production of documentation, procedures and control methods to assist both plants. The plan was to implement the same ideas into both plants to lower possible confusion by any persons who would potentially visit or work at both sites. Both plants operate differently so there are some slight differences in the procedures and control methods to accommodate this. However anything that was identified as universally having a major impact on both plants was managed and controlled identically. Outside expertise was utilised to point teams in the correct direction. A relationship has been maintained with external experts for assistance with audits and assisting with any obscure issues as they arise.



Figure 1: *Elanora Digesters*



Figure 2: *Coombabah Digesters*

2.0 DISCUSSION

2.1 Biomethane

Biomethane is a hydrocarbon gas produced during the breakdown of organic matter in the absence of oxygen. It has been utilised as a fuel gas for 150 years in many countries. Depending on its source, biomethane can comprise of the compounds shown in Table 1.

Table 1: *Typical composition of biogas*

Compound	%
Methane	50-85
Carbon Dioxide	5-50
Hydrogen	0-1
Hydrogen sulphide	0-3
Nitrogen	0-5
Oxygen	0-2

2.2 Achieving Compliance

The safe operation and management of biomethane installations is governed by the *Petroleum and Gas Act 2004* and the *Petroleum and Gas Regulation 2004*. There are several key requirements that are relevant to biomethane gas which must be understood and implemented to assist the operating plant in achieving compliance. These include:

- a Safety Management Plan (SMP) for the plant,
- the nomination of persons to occupy three statutory positions each with specific obligations (including Site Safety Managers),
- a comprehensive risk assessment when using unodourised gas,
- approval processes for the design of relevant gas burning devices and
- a requirement for installers to be licensed or competent under the SMP.

Addressing these requirements was one of the major hurdles encountered by Gold Coast Water as there were a limited amount of experienced people who were able to assist in the design and production of the required paper work. The Department of Natural Resources and Mines have produced an invaluable document in the 'SafeOP for Petroleum and Gas, a guide to legislative requirements for operating plant - 2005' and also a self-audit tool. Both these documents have been designed to assist petroleum and gas operators 'flesh out' the Act in regards to the SMP and the other legislative obligations that they may face.

Both documents were used extensively during the documentation design process and continue being utilised for scheduled audits. The safety management plan is a living document and must be continually maintained and updated. Scheduled maintenance and reporting records are kept on-site and installed into a filing system that can be easily accessed by all staff and can be referred to during an audit of the SMP.

It is a requirement under the Act that an Annual Safety Report be lodged with the Regulator, being Chief Inspector of Petroleum and Gas, in relation to the previous financial year.

The report must address several key areas of the operation of the plant, including:

- a description of the plant, its location and operations
- the names and contact details of the persons allocated to the statutory positions
- any significant safety risks
- whether or not the activities of the plant complied with the Safety Management Plan and The Act for that year.

The Annual Safety Report must be submitted to the Chief Inspector before the 1st of September each year. For this reason audits have been scheduled on both the treatment plants in July. This allows for updates to be done to the SMP and for any upgrade or repair action plans to be included and for the Operator to write the letter.

2.3 Audits

An audit process needs to be established to monitor the effectiveness of the SMP and to check that all workplace activities comply with it. Gold Coast Water operates under a Quality and Environmental Management System (QEMS). Utilising this system the project team set up a twice-yearly audit schedule, one audit scheduled for January and one for July. The January audit is used as a monitoring audit to see how the plant is running and whether any new forms and procedures that have been put into place are working. The July audit, as previously stated, is utilised to assist in the writing of the Annual Safety Report.

Both audits are run as two-part audits utilising the self-audit tool. This allows for a systematic audit of the SMP and the plant. The first part of the audit is a step-by-step component of the audit tool and the SMP during which any copies of documentation that the Petroleum and Gas SafeOP require must be presented or location of its storage must be identified. The second part of the audit is a site walk around to check that all control measures for the site are in place and working.

A regular audit schedule has allowed us to maintain the Safety Management Plan as a living document. Petroleum and Gas producing facilities may be audited by the chief inspectorate at any given time so an up-to-date SMP and an effective document control system are vital in complying with the Act.

2.4 Control Measures

The presence of hazardous and toxic gases within the digester area has meant that controls measures have had to be implemented across both sites that limit access to the digesters and control any work that may occur. By enforcing these control measures the Site Safety Managers are more efficiently able to provide a safer working environment for all staff. Any documentation used in the control and record keeping of the area is kept on file at both sites and is produced during any audit.

Control measures that have been put into place include:

- fencing of the digesters and associated area's
- warning signage on all access gates stating the hazards people may encounter
- implementation of a Hazardous Area Entry Procedure
- implementation of a Hazardous Area Permit to Work
- Hazardous Area Awareness training courses for all staff
- Hazardous Area Management course for senior staff
- Hazardous Area Zone delineation marked

- dual means of escape from roof of digesters – stairways and escape chute
- installation of intrinsically safe equipment
- installation of Type B gas appliances and record keeping of all appropriate certification
- implementation of scheduled gas leak monitoring and pipework inspections
- regular maintenance scheduling on hazardous equipment.
- implementation of a Hazardous Area Dossier for all electrical components that are within the designated hazardous area zones.

2.5 Other Considerations And Obligations

There are several other obligations that are required to be met to assist a biogas producing plant in meeting compliance with the *Petroleum Gas Act* and Regulation. There is a requirement under section 628 of the Act that states that any fuel gas must be odourised (i.e. made to smell) unless used in an industrial application, however there are several requirements that must be met.

Biogas is said to be unodourised even though a certain amount of H₂S is present. In biogas it cannot be utilised as an odorant. H₂S is detectable at only a few parts per million (ppm) and can be completely undetectable. The effect of H₂S on the olfactory nerves used for smell and the fact that prolonged or substantial exposure can be fatal means that under no circumstances can it be utilised for the odourisation of biogas. This means that another substance must be implemented into the gas train.

The use of biogas is for an industrial application at Coombabah and Elanora STPs. Under the Act a risk assessment on the use of unodourised biogas for an industrial application must be conducted by an appropriately qualified person. The risk assessment for Coombabah and Elanora STPs demonstrated that the supply was safe and that appropriate gas detection and safety shutdown systems were in place. This meant the gas did not have to be odourised

The Coombabah and Elanora biogas plants are classified as utilising industrial devices to run and utilise the biogas. This means that all appliances must meet Type B certification. To meet a Type B certification all the relevant technical, design and operating information for each device must be submitted to an approving authority. When approved, all gas work must then be completed by a licensed and authorised person under the Act. Once installation is complete it must then be certified under section 697 of the Act.

A hazardous area dossier has been compiled for each individual treatment plant. This dossier covers all electrical installations that are in any of the designated hazardous area zones around the digesters. Similar to the SMP, it is classed as a living document and must be continually updated and maintained. Any work that is done on a device must be recorded and filed accordingly. This allows for a paper trail to exist on each device and if there is ever an incident involving a particular item its maintenance and historical data can be easily accessed. To allow for accountability and responsibility of people to update the dossier for any work they have done, there has been a simple check and tick section included on the bottom of the 'Hazardous Area Permit to Work'. This is required, to be completed before the permit is signed off by the Site Safety Managers.

3.0 CONCLUSION

Moving the Coombabah and Elanora treatment plants forward in achieving compliance with the *Petroleum and Gas Act 2004* and Regulation has been a major learning curve for all involved. Utilising a group of people with varying skill sets has proven beneficial as Gold Coast Water was able to work through and remedy any issues that were encountered. One of the major hurdles we encountered were the installation of new policies and procedures into work areas that had previously worked without such a controlling regulation. New policies and procedures are never a welcome inclusion into a work force as some people view them as just an extra workload. However due to the responsibilities placed on the Executive Safety Manager, the Operator and the Site Safety Managers, a strict and controlling procedure must be put into place to allow for safe and efficient work practices. A person's safety should never be compromised and full enforcement of the SMP and its corresponding documentation allows for the Site Safety Manager, who is usually the person working in direct contact with people entering and working around digesters, to effectively control his biogas plant.

There is a requirement for all persons directly involved in the production and use of biogas to continually update their skills base and knowledge. The Department of Natural Resources and Mines has a newsletter that is frequently issued which covers all things gas and gas production. It is recommend that operators working with biogas keep a regular look at the website as it is continually updated with safety reports and information in regards to the gas industry.

4.0 ACKNOWLEDGEMENTS

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Richard Went - Manager Operational Strategy

5.0 REFERENCES

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